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Full Length Research Paper

Rational drug prescribing for elderly inpatients in a Brazilian hospital: A pilot study

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Inadequate prescriptions are one of the biggest causes of adverse events related to medications. The aim of this study was to evaluate rational drug prescribing for elderly inpatients. A cross-sectional study was conducted to monitor the quality of drug prescriptions of patients admitted from May to August 2009, in a cardiovascular ward in Brazil. The quality evaluation of drug prescribing for elderly inpatient medication appropriateness was assessed by detection of potentially inappropriate medications, therapeutic duplicity and drug interactions. A total of 62 elderly inpatients were included, 71% were female, median age was 77.5 years. Number of medications prescribed was 3818, ranging from 3 to 25 medications per prescription. Polypharmacy was highly common (86%) in analyzed prescriptions. 370 prescriptions were analyzed (6 prescriptions per patient). We reviewed 370 medication orders (3818 prescribed drugs), 34% of which had at least one potentially inappropriate medication for the elderly, 70% presented therapeutic duplicity. Drug interactions were detected in 77% of prescriptions. Positive associations were observed between therapeutic duplicity and potentially inappropriate medications and between therapeutic duplicity and severe drug interactions. Our study show high rate of inappropriate prescriptions, which can influence the effectiveness of pharmacotherapy as much as the elderly safety.

Key words: Rational drug prescribing, elderly, inpatients.

INTRODUCTION

During the last century various factors contributed to the situation of worldwide population aging, among which stands out the socio-economic progress that has been implicated in the change of conditions of people's living and in the incorporation of new technologies (Fernandez-Llimos et al., 2005). This increment in life expectation leads to a greater prevalence of chronic diseases and the increase in demand for care and technologies in health, with emphasis on the utilization of medications (Spinewine et al., 2007).

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On the other hand, inadequate use of medications is considered as a risk factor to health, in view that it provokes an elevated rate of morbid-mortality throughout the world (Fernandez-Llimos et al., 2004; Hustey, 2008). In this situation, inadequate prescriptions present a high potential for medication interactions, medications potentially inadequate, and therapeutic duplicity (Spinewine et al., 2007; Ryan et al., 2009; Gurwitz et al., 2003). It is worth emphasizing that these prescriptions are one of the biggest causes of adverse events related to medications and that they increase the probability of occurrence in the elderly, especially in the presence of polypharmacy (Bergman et al., 2007).

Some other important information is that the elderly population presents multiple clinical conditions associated to chronic diseases, utilizing more

medications for treating them when compared to younger populations (Spinewine et al., 2007; Bressler and Bahl, 2003). Therefore, the risk of inadequate prescriptions is increased in this age group. Adding to this, there are physiological changes linked to age that altering the pharmacokinetics and pharmacodynamic characteristics, affecting the absorption, distribution, metabolism, and excretion of drugs, which makes this population even more fragile (Mallet et al., 2007).

Faced with such particularities, it is necessary to reduce the incidence and prevalence of adverse events related to inappropriate prescriptions in the elderly, mainly because the greater part of these events are preventable (Lisby et al., 2005). In the last years, studies carried out in Brazil showed a high consumption of inappropriate drugs by elderly (Aguiar et al., 2008; Ribeiro et al., 2008; Nassur et al., 2010). From this perspective, the aim of this study was to evaluate rational medication prescribing for elderly inpatients.

MATERIALS AND METHODS

Setting

This study took place in a private hospital located in the city of Aracaju – SE, Northeastern Brazil. This medium-sized 125-bed hospital of high complexity is a reference center for hospital medical care in the State; furthermore, it is linked to teaching institutions and acts as a school hospital.

Study design

This was a cross-sectional study that was conducted to monitor the quality of prescriptions of patients admitted from May to August 2009. Since data collection was performed daily, from Monday to Friday, weekends' prescriptions were excluded, as well as inpatients who did not receive pharmacotherapy.

Population

Adult inpatients (> 65 years of age) admitted in the hospitalization ward during the period of study which the main diagnosis was coded into "Diseases of the circulatory system" category – according to 10th international classification of diseases (ICD-10) of the world health organization (WHO) were included in the study.

Data collection

Data were collected through a structured form developed by the researchers based on related literature (WHO, 2001). In order to standardize data collection, field researchers were trained and supervised during a 15 day pilot study.

Prescription analysis

Physicians' prescriptions were evaluated in agreement with the literature (Chrischilles et al., 2009). Rationality of pharmacotherapy is related to quality, safety, and cost-effectiveness:

1. Potentially inappropriate medications: are drugs with unfavorable benefit to risk ratio when other safer or more efficient therapeutic alternatives are available. They were investigated according to the most recent review of Beers criteria (Fick et al., 2003).
2. Therapeutic Duplicity: is the use of two or more drugs of the same therapeutic class for the same clinical condition. In this study, the anatomical-therapeutic-chemical (ATC) Classification was utilized as a tool for determining therapeutic class (WHO, 2009).
3. Potential drug-drug interactions were assessed using the Micromedex® Drug-Reax® system. Drug interactions were categorized as 'major', 'moderate' or 'minor', according to the severity. Micromedex® defines 'major' may be life threatening and/or require medical intervention to minimize or prevent serious adverse effects. 'Moderate' interactions may result in exacerbation of the inpatient's condition and/or require an alteration in therapy. Finally, 'minor' interactions would have limited clinical effects. Manifestations may include an increased in the frequency or severity of the side effects but generally would not require a major alteration in therapy.

Statistical analysis

Analysis was performed using SPSS 17.0 (SPSS Inc., Chicago, U.S.A.). The statistical analysis was performed using the Chi-Square test with an assumption that p value ≤ 0.05 is significant.

Ethical issues

This study was approved by the Research Ethics Committee and authorized by the directors of study hospital. The purpose of the present work was neither to find out nor to identify the professional that committed the flaw, but to analyze and detect the prescription errors, making the medication system safer for its users. Therefore, the collected data was used exclusively by the researchers, guaranteeing the privacy of the information obtained.

RESULTS

A total of 62 elderly inpatients had their prescriptions analyzed, 44 (71%) were female, age varied from 65 to 94 years (median age 77.5 years) (Table 1). There was a positive association between frequency of prescriptions and female gender, and age. The most consumed drugs were those for Cardiovascular System (25, 7%) and those for Alimentary and Metabolism Treatment (22, 6%) (Table 2).

Number of medications prescribed was 3818 (median number per patient was 11), ranging from 3 to 25 medications per prescription. Therefore, polypharmacy was highly common (86%) in analyzed prescriptions. 370 prescriptions were analyzed (6 prescriptions per patient).

According to measures of prescription quality proposed in this study, 1489 potential drug-drug interactions (DDIs) were detected in 77% of the prescriptions. The number of interactions per prescription varied from 1 to 20 with a median of 4 (Figure I). Regarding DDI severity, 31% were classified as severe and 64% were considered as moderate. Some examples of severe DDI most observed

Table 1. Characteristics of sample included in the study (Brazil, 2009).

No. of patients	**62**
Gender	
Females, n (%)	44 (71%)
Male, n (n%)	18 (39%)
Age	
Mean, years (SD)	77.5 (7.8)
Min-Max, years	65 - 94

Table 2. Distribution of drugs used by elderly (n = 3818), according to the Anatomical-Therapeutic-Chemical Classification System - ATC levels 1 and 2 (Brazil, 2009). * Absolute and relative frequencies calculated disregarding the drugs for which no classification was possible: n = 19.

Categories	**Code Atc**	**n**	**%**
Cardiovascular system	**C**	**982**	**25.7**
Cardiac therapy	C01	126	
Diuretics	C03	247	
Peripheral vasodilators	C04	14	
Vasoprotectives	C05	59	
Beta blocking agents	C07	142	
Calcium channel blockers	C08	54	
Agents acting on the renin-angiotensin system	C09	203	
Serum lipid reducing agents	C10	137	
Alimentary tract and metabolism	**A**	**865**	**22.6**
Antacids/ drugs for treatment of peptic ulcer/ flatulence	A02	286	
Antispasmodic and anticholinergic agents and propulsives	A03	213	
Antiemetics And antinauseants	A04	1	
Laxatives	A06	80	
Antidiarrheals, intestinal anti-inflammatory/anti-infective agents	A07	40	
Drugs used in diabetes	A10	245	
Nervous system	**N**	**633**	**16.5**
Analgesics	N02	339	
Antiepileptics	N03	78	
Anti-parkinson drugs	N04	05	
Psycholeptics	N05	100	
Psychoanaleptics	N06	86	
Other nervous system drugs	N07	25	
Blood and blood forming organs	**B**	**575**	**15.1**
Antithrombotic Agents	B01	467	
Antianemic Preparations	B03	56	
Blood substitutes and perfusion solutions	B05	52	
Respiratory system	**R**	**339**	**8.8**
General antiinfectives for systemic use	**J**	**312**	**8.2**
Musculo-skeletal system	**M**	**33**	**0.9**
Systemic hormonal preparations, excluding sex hormones and insulins	**H**	**60**	**1.6**

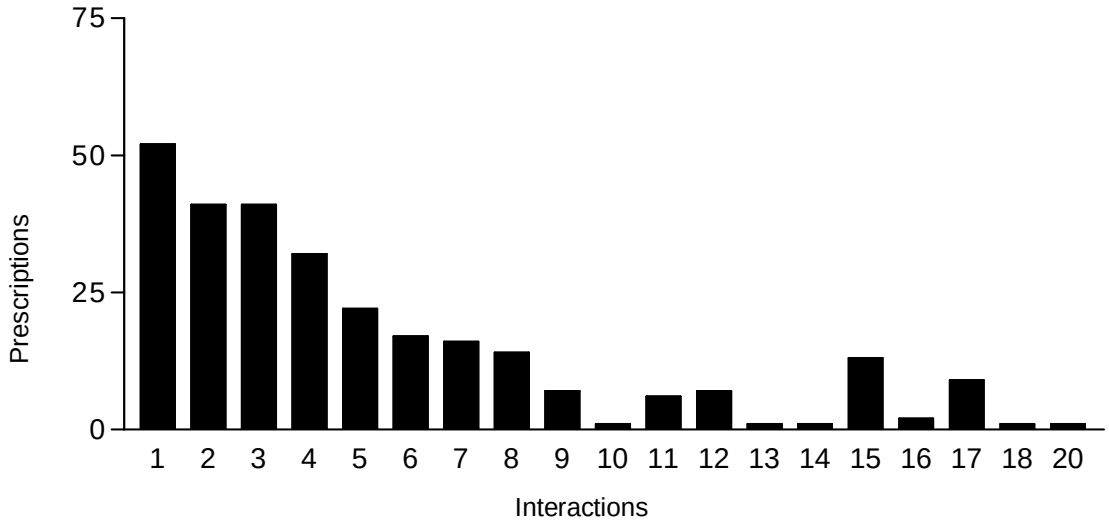

Figure 1. Distribution of drug interactions analyzed by prescription in the period from May to August 2009, private hospital in Brazil.

Table 3. Distribution of drug potentially inappropriate for the elderly (n = 116) (Brazil, 2009).

Drugs	Concern	n	%
Amiodarone	Associated with QT interval problems and risk of provoking torsades depointes. Lack of efficacy in older adults.	75	64.6
Mineral Oil	Potential for aspiration and adverse effects. Safer alternatives available.	28	24.1
Diazepam	These drugs have a long half-life in elderly patients (often several days), producing prolonged sedation and increasing the risk of falls and fractures. Short-and intermediate-acting benzodiazepines are preferred if a benzodiazepine is required.	6	5.2
Nifedipine	Potential for hypotension and constipation.	5	4.3
Amitriptyline	Because of its strong anticholinergic and sedation properties, is rarely the antidepressant of choice for elderly patients.	2	1.7

were: aspirin and warfarin, amiodaron and warfarin and clopidogrel and enoxaparin.

The therapeutic duplicity was observed in 70% of the prescriptions. The therapeutic classes with the greatest percentage of duplicity were the antithrombotic (38.5%) and diuretic (22.3%) agents. Regarding the potentially inappropriate medication for the elderly, 31.3% of the prescriptions contained at least one drug considered inappropriate. Table 3 shows the distribution of drug potentially inappropriate for the elderly.

Positive associations were observed between therapeutic duplicity and potentially inappropriate medications ($p < 0.0001$) and between therapeutic duplicity and severe drug interactions ($p < 0.0001$).

DISCUSSION

Our study demonstrated a higher frequency of prescriptions in female gender, and older persons, as well a higher number of medications prescribed. These results corroborate that main risk factors to elderly when they receive an inappropriate prescription are of female gender, poorer in health status, and subjected to polypharmacy (Barry et al., 2008).

Polypharmacy in the elderly population is a well-known problem and many studies have been carried out to quantify the extent of the problem (Gallagher et al., 2007; Schuler et al., 2008). Bergman et al. (2007) defined polypharmacy as the concomitant use of six or more

medications, where affirm that the risk for inappropriate medication increased greatly at this threshold. Our results corroborate other studies (Schuler et al., 2008; Steinman et al., 2006), confirming that polypharmacy in the elderly is a rule and not an exception. According to Rollason and Vogt (2003), polypharmacy has many adverse consequences in this age group, among which DDIs are, the most common problem observed in our study. DDIs represent an important part of the problems related to medications and have been found in up to 15% of the elderly with polypharmacy (Radosevic et al., 2008).

The prevalence of therapeutic duplicity in this study was higher than that reported by Schuler et al. (2008), which found that 7.6% of the prescriptions contained duplicity. The highest percentage is due to considerable number of medications prescribed by their brand name (Siqueira et al., 2011). Since prescribing using trade names implicate the risk of duplicate when the physician does not exactly know which drug or drug combinations are contained in the medication. Moreover, prescribing trade-name drugs implicates a higher probability of confusing look alike/sound alike drug names, thus prescribing a not indicated medication that could harm the patient.

In general, the association of antithrombotic drugs reduces morbidity and mortality, however their adverse effects or their incorrect use may cause increase in the risk of bleeding, especially among older patients (Avezum et al., 2005). Clinical trial data indicate that diuretics are usually well tolerated and decrease progression of hypertension, incidence of stroke, coronary events and congestive heart failure (The ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group, 2002). Nevertheless, higher doses have been shown to add minimal extra antihypertensive efficacy and are associated with hypokalemia and other adverse effects (Flack and Cushman, 1996). According to O'Mahony and Gallagher (2008), the optimisation of monotherapy within a single drug class should be observed prior to considering a new agent.

The rate of prescriptions containing potentially inappropriate medications for the elderly in this study was similar to studies conducted in North America and Europe, which reported estimated prevalence rates ranging from 2.8 to 40.0% (Laurier et al., 2002; Onder et al., 2003; Heininger-Rothbucher et al., 2003). This large range in prevalence rates can be accounted by the different types of settings, sample sizes, study designs, data sources, and data collection periods.

Although most studies of inappropriate prescriptions in elderly have focused on themes such as therapeutic duplicity, drug interactions and potentially inappropriate medications, the association between them has not been well studied. These data are important because Beers' Criteria do not include severity of drug–drug interactions and make no reference to duplicity (Gray et al., 2003).

In clinical routine, the physicians have an essential task of rationalizing elderly prescriptions, preventing the negative aspects of polypharmacy (Wawruch et al., 2007). According to Avorn (2004), the use of interdisciplinary teams to care for elderly patients may provide opportunities to substantially improve the quality and safety of drug therapy in this population. Such teams may include the involvement of nurse specialists, clinical pharmacists, and other health professionals, complementing and extending the efforts of the physician.

Study limitations

There are limitations of this study. First, its monocentric and time-limited study design. We also exclusively recruited patients on cardiology/cardiovascular wards, excluding patients with other diseases. We also exclusively recruited patients on cardiology-/cardiovascular wards, excluding patients with other diseases. However, as our primary focus was on quality prescribing, such limitation, which resulted in a specific range of drugs and treatment protocols, permitted a more accurate analysis of drug-drug interactions and potentially inappropriate medications under a clinical point of view. Therefore, we believe that the basic findings of this study can be extrapolated to related pathological conditions and associated assist modes.

Conclusion

Despite its limitations, the obtained data show low rationality of the prescriptions used by the elderly, possibly causing more harm than benefits. Therefore, we understand that the greatest challenge of health systems is training healthcare professionals to optimize the prescription's rationality of elderly, assuring the effectiveness of treatments and the safety of this population that is growing worldwide.

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